

WE CLAIM:

1. A system for enabling the real time buying and selling of electrical power between a fuel cell powered vehicle and a consumer of electricity, the system
5 comprising:
 - vehicle connections arranged to cooperate with the vehicle for the supply of a fuel to the vehicle and for transfer of electricity to and from the vehicle;
 - a calculating device for determining the current cost of fuel and price paid for generating electricity using data and information received by the calculating
10 device via a network of a network communication system; and based at least on a cost of fuel and a price paid for generating electricity, for determining whether to make the fuel cell powered vehicle available for generation of electricity by performing one or more calculations based on the data and information received via the network; and
 - 15 a controller for regulating the process of consumption of fuel by the vehicle and the generation of electricity by the vehicle based on the determining by the calculating device;
 - wherein, when fuel is consumed by the vehicle and electricity is generated by the vehicle, the calculating device further collects data on the quantity
20 of fuel consumed and the amount of electricity generated, to calculate the cost of the fuel and the value of the electricity generated, and to provide a debit charge for the cost of fuel consumed and a credit charge for the value of electricity generated, thereby accounting for fuel consumed and electricity generated by the vehicle; and wherein the network communication system provides real time communication
25 between at least the fuel cell powered vehicle and the consumer of electricity to facilitate the real time buying and selling of electrical power.
2. A system as claimed in claim 1, wherein the calculating device
30 determines whether to make the fuel cell powered vehicle available for generation of electricity based also on operating and maintenance costs.

3. A system as claimed in claim 1, wherein the calculating device determines whether to make the fuel cell powered vehicle available for generation of electricity based also on a fuel cell efficiency rating of the vehicle.

5 4. A system as claimed in claim 1, 2 or 3, wherein the vehicle is one of a plurality of vehicles connected to each other in a system for generating electricity, and wherein the calculating devices of the plurality of vehicles cooperate to set a load level for each respective vehicle, to generate electricity at the lowest possible cost.

10 5. A system as claimed in claim 3, wherein the vehicle has a computing device and data storage device, wherein data relating to the cost of fuel gas and the price paid for generating electricity is stored in the data storage device, and wherein the computing device is programmed to calculate continuously whether the vehicle should
15 be made available for generation of electricity.

6. A system as claimed in claim 5, wherein the data storage device has an input for receiving data indicating an acceptable spread between the price paid for electricity and the cost of gas.

20 7. A system as claimed in claim 6, wherein the vehicle has an interface operable by an operator of the vehicle to indicate that the vehicle is available for electricity generation, for setting parameters based on fuel and electricity costs for determining the availability of the vehicle for electricity generation, and for passing
25 control of the vehicle to an energy service provider.

8. A system as claimed in claim 3, wherein the network communication system is adapted to provide real time communication over the network between the vehicle and the fuel gas supplier, as well as between the vehicle and the energy service
30 provider, to determine the cost of fuel gas by real time pricing between the vehicle and a fuel gas supplier, and to determine the price paid for electricity by real time pricing between the vehicle and an energy service provider respectively.

9. A system as claimed in claim 8, in which one of a vehicle owner and vehicle operator negotiates a contract via the network with at least one of: a fuel gas broker, for supply of fuel gas; and an energy service provider, for purchase of electricity.

5 10. A system as claimed in claim 9, wherein the fuel gas broker and the energy service provider are a single entity and wherein the negotiated contract is a single contract providing for payment of a net credit to an account associated with the vehicle.

10 11. A system as claimed in claim 7, the system further comprising:

a plurality of docking stations for vehicles and a communication connection between the docking stations and an energy service provider, each docking station including connections for the supply of fuel gas to and transfer of electricity from a vehicle;

15 wherein the network communication system is adapted to permit each vehicle operator to transmit to the energy service provider a notification of the availability of the operator's vehicle for electricity generation and any limitations on the vehicle availability determined from fuel and electricity costs over the network and

to permit the energy service provider to send control signals to
20 individual vehicles to actuate individual fuel cell powered vehicles as requested and to set load levels for individual vehicles over the network, thereby to meet current electrical demand.

12. A system as claimed in claim 11, wherein data is communicated via the
25 network between the energy service provider and the individual vehicles, each vehicle having a unique identification, whereby each vehicle can be uniquely identified, irrespective of the location of the vehicle.

13. A system as claimed in claim 12, wherein the network is the Internet.

30 14. A system as claimed in claim 13, wherein the network is adapted for both hardwired and wireless communication.

15. A system as claimed in claim 12, wherein the system further comprises an energy aggregating device and wherein the energy service provider acts as an aggregator utilizing the energy aggregating device to aggregate electricity generated by a plurality of vehicles into a single electricity source for resale and distribution.

16. A system as claimed in claim 15, wherein the system further comprises a fuel disaggregating device, so that fuel gas purchased in bulk is disaggregated by the disaggregating device, by charging each vehicle for a portion of the bulk fuel gas used by the vehicle.

17. A system as claimed in claim 16, wherein the energy service acts as a disaggregator utilizing the fuel disaggregating device, the energy service provider purchasing fuel gas in bulk at one rate and charging each vehicle for a portion of the bulk fuel gas used by the vehicle at a second higher rate.

18. A system as claimed in claim 15, wherein the calculating device calculates a rate is set for purchase of electricity from each vehicle at an interruptible rate, to facilitate aggregating electricity generated by the plurality of vehicles by the energy aggregating device to create a substantially uninterruptible electricity supply, so that the aggregated electricity can be resold at a higher, uninterruptible rate.

19. A system as claimed in claim 18, further comprising a system computing device connected to the network communication system programmed to: determine, for any given time period, the number of vehicles that will be available for generating electricity; for calculating a maximum electrical power that could be generated from the vehicles; calculate a likelihood that a certain percentage of the vehicles may not be available for generating electrical power determined from measured data and stored data selected from geographical location, time of day, day of the week and seasonal factors; calculate a marginal power level that would be generated from the certain percentage of vehicles; and subtract the marginal power level from a maximum electrical power, to give a net power level, to determine a reliability factor for the net power level, to enable

the offering for sale of generated electricity at the net power level, at a price that takes into account the reliability factor.

20. A system as claimed in claim 15, wherein the energy aggregating device
5 permits at least a portion of the electricity of the single electricity source to be utilized locally, to leave a balance amount of generated electricity for resale and distribution.

21. A system as claimed in claim 20, wherein the vehicles comprise inverters
for inverting generated DC power into AC power, and AC drive motors for receiving
10 the AC power, the inverters having at least one frequency that is compatible with a conventional electricity transmission grid.

22. A system as claimed in claim 20, wherein the docking stations are
arranged at a single location and connected to a common energy aggregation unit, the
15 common energy aggregation unit connected to local, electricity consuming devices for local consumption of electricity, and through a net metering device to an electricity supply and transmission grid, whereby, for any given time period, the net amount of electricity taken from the grid or supplied to the grid is measured using a measuring device.

20 23. A system as claimed in claim 15, wherein the network communication system facilitates communication over the network between the energy service provider and one or more of a dock provider that manages the docking stations, a fuel supplier, a fuel transmission/distribution company, an electricity utility for managing supply of
25 electricity to an electricity consumer, at least one electricity consumer, and an electricity transmission grid provider.

24. A system as claimed in claim 12, wherein the data communicated over the network comprises
30 notifications of the availability of each vehicle to a docking station, and from each docking station to the energy service provider;

instructions via the network, when required, from the energy service provider for each vehicle to enter a run mode;

status updates for each vehicle, when in the run mode, to the energy service provider via the network;

5 requests from the energy service provider to place generated electricity onto the electricity grid at a specified location associated with the docking station;

after receiving permission from the grid, instructions from the energy service provider for individual vehicles to commence electrical power generation via the network; and

10 data used in by the energy service provider to continually monitor power generation from each vehicle and adjust load levels of each vehicle to generate a required amount of electricity via the network.

25. A system as claimed in claim 24, wherein at least one notification
15 communicated from each vehicle to a respective docking station via the network is encrypted, the docking station having a communications device adapted to:

contact the energy service provider to verify the authenticity of the encrypted notification;

pass a first secured token to a fuel transmission and distribution manager
20 and a second secured token to an electricity grid transmission and distribution manager via the network after authentication of the notification;

enable supply of fuel gas to the vehicle and electricity supplied from the vehicle to the docking station via said network;

log all data to a database and transmit data via the network to the energy
25 service provider; and

transmit an electronic bill for services to the energy service provider at an end of each generation session.

26. A system for enabling the real time buying and selling of electrical power
30 between a vehicle having a fuel cell power unit and an energy service provider utilizing a

network of a network communication system adapted to provide real time communication between at least the vehicle and the energy service provider to facilitate the real time buying and selling of electrical power, the system comprising:

connections to at least one vehicle for the supply of a fuel and for
5 transfer of electricity;

a controller on each vehicle adapted to hand over control of the fuel cell power unit of each respective vehicle to an energy service provider, to enable the energy service provider to make determinations of when to operate the fuel cell power unit of each vehicle and to set the load level for each fuel cell power unit using data and
10 information received via said network;

and wherein each controller is further adapted to control

the process of consumption of fuel by each respective vehicle and the generation of electricity by the respective vehicle based on the determinations made,
and

15 to collect data on the quantity of fuel consumed and amounts of electricity generated, when fuel is consumed by each respective vehicle and electricity generated by each respective vehicle, and for calculating the cost of the fuel and the value of the electricity generated, thereby accounting for fuel consumed and electricity generated by the respective vehicle.

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27. A system as claimed in claim 26, wherein the network communication system is further adapted to provide real time communication over said network between the energy service provider and at least one fuel gas supplier, to determine the cost of fuel gas by real time pricing via the network between the energy service provider
25 and at least one fuel gas supplier.

28. A system as claimed in claim 27, wherein the network communication system is further adapted to provide real time communication over said network between said energy service provider and an owner or operator of each vehicle, to set

the price paid for purchasing electricity by real time pricing via the network between the energy service provider and an owner or operator of each vehicle.

29. A system as claimed in claim 28, in which one of a vehicle owner and
5 vehicle operator negotiates a contract via the network with at least one of: a fuel gas broker, for supply of fuel gas; and an energy service provider, for purchase of electricity.

30. A system as claimed in claim 29, wherein the fuel gas broker and the
10 energy service provider are a single entity and wherein the contract is a single contract providing for payment of a net credit to an account associated with the respective vehicle.

31. A system as claimed in claim 26, wherein the price paid to a vehicle
15 owner for generating electricity is based on a flat fee for a defined period of time.

32. A system as claimed in claim 31, wherein the defined period of time is chosen from one of the following: day, week, month, or year.

20 33. A system as claimed in claim 26, further comprising:

a plurality of docking stations for vehicles and a communication connection between the docking stations and the energy service provider, each docking station including connections for the supply of fuel gas to and transfer of electricity from a vehicle;

25 wherein the network communication system is adapted to permit each vehicle operator to transmit to the energy service provider a notification of the availability of the operator's vehicle for electricity generation and any limitations on the vehicle availability determined from fuel and electricity costs via the network; and

to permit the energy service provider to send control signals to
30 individual vehicles to actuate individual fuel cell powered vehicles as requested and to set load levels for individual vehicles via the network, thereby to meet current electrical demand.

34. A system as claimed in claim 33, wherein data is communicated via the network between the energy service provider and the individual vehicles, and providing each vehicle with a unique address whereby each vehicle can be uniquely identified,
5 irrespective of the location of the vehicle.

35. A system as claimed in claim 34, wherein the energy service provider acts as an aggregator and aggregating electricity generated by a plurality of vehicles into a single electricity source for resale and distribution.

10 36. A system as claimed in claim 33, 34 or 35, wherein the system further comprises at least one of:

a fuel gas meter arranged at the vehicle, or associated docking station and at the fuel gas supplier, and a fuel gas reconciling system for reconciling the different
15 metered amounts; and

an electricity meter arranged at the vehicle, or associated docking station and an electricity purchaser, and an electricity metering reconciling system for reconciling the different metered amounts.

20 37. A system as claimed in claim 36, wherein the flow of fuel gas to and generation of electricity by a vehicle is terminated by the respective controller if any reconciliation shows an error outside an acceptable tolerance.

38. A system of generating electrical power utilizing fuel cell power units of
25 vehicles, the system comprising;

connections to a plurality of fuel cell powered vehicle for the supply of a fuel and for transfer of electricity from the vehicle;

a fuel supply associated with each vehicle and a fuel controller to measure and charge for fuel used by each vehicle;

30 electricity receiving device for receiving electricity generated by each vehicle, wherein the electricity received is paid for at a first, interruptible rate; and

an aggregation unit for aggregating the electricity generated by the plurality of vehicles, wherein the aggregated electricity is resold as an uninterruptible electrical supply at a higher, uninterruptible rate.

5 39. A system as claimed in claim 38, wherein the fuel supplied to each vehicle is supplied in bulk at a first rate, and resold in smaller, discrete amounts to individual vehicles at a second, higher rate.

40. A system as claimed in claim 38 or 39, wherein the system further
10 comprises a plurality of docking stations, the docking stations being connected to the aggregation unit for aggregation of electrical power generated from the vehicles, and transmitting means for transmitting the aggregated power from the aggregation unit to an electricity transmission and distribution grid.

15 41. A system as claimed in claim 40, wherein at least all or some of the electricity generated is utilized locally, and only a balance of the electricity generated is resold and transmitted to the electricity and transmission grid.

42. A system of generating electricity from the fuel cell power unit of a fuel
20 cell powered vehicle, the system comprising;
a vehicle having a fuel supply;
vehicle connections over which electricity generated in the fuel cell power unit is transferred from the vehicle;

an electricity generation system coupled to the vehicle by the vehicle
25 connections, wherein the electricity generation system is adapted to divide the generated electricity into first and second portions, and permit the first portion of generated electricity to be consumed locally,

to transmit and sell the second portion of generated electricity to an electricity transmission and distribution grid; and

to meter the net amount of electricity transmitted to the transmission and distribution grid, or taken from the transmission and distribution grid, in a set time period.

5 43. A system as claimed in claim 42, wherein the system is located in an individual dwelling.

44. A system as claimed in claim 42, wherein the system further comprises a plurality of docking stations for vehicles, each docking station having a supply of fuel
10 and means for transmission of electricity, the docking stations connected to an aggregation unit for aggregation of generated power, wherein the docking stations transmit aggregated power from the aggregation unit to a transmission and distribution grid, and where a meter is connected between the aggregation unit and the transmission and distribution grid.

15 45. A system of generating electrical power from a vehicle including a fuel cell power unit and financing the cost of the vehicle, the system comprising:

a fuel cell powered vehicle operated by the vehicle operator;

a controller for the vehicle enabling the vehicle operator to enter into a
20 contract providing for at least one of an initial lump sum payment and regular payments to cover at least part of the cost of the vehicle;

wherein the contract provides for the operator to commit to parking the vehicle at selected docking stations for generation of electricity;

a fuel supply for supplying fuel to the vehicle when the vehicle is
25 parked at one of the selected docking stations;

wherein electricity is generated from the fuel cell power unit of the vehicle for sale when the vehicle is parked, to generate income generated from the sale of electricity to cover part of the cost of the vehicle.

30 46. A system as claimed in claim 45, wherein the contract comprises one of a rental agreement, a purchase agreement, and a lease agreement.

47. A system as claimed in claim 46, wherein the contract provides for regular payments payable at an interval selected from one of weekly, monthly and quarterly.

5 48. A system as claimed in claim 45, which includes providing in the contract for the operator to commit to having the vehicle parked at said selected docking stations for a minimum amount of time within a prescribed time period.

49. A system as claimed in claim 48, which includes providing for making
10 payments to the operator of the vehicle, when the amount of electricity generated by the vehicle is greater than a set amount within a set period.

50. A network communication system, comprising:
a network to which a plurality of vehicles and a plurality of docking
15 stations are coupled;
wherein each of the plurality of vehicles comprises a fuel cell unit;
wherein each of said plurality of vehicles and said plurality of docking stations is associated with a unique digital identifier; and
wherein the identifier facilitates identifying the respective vehicle or
20 docking station in said network.

51. A network communication system of claim 50, wherein said identifier further facilitates at least one of metering operations of the fuel cell unit of the respective vehicle, reporting operations of the fuel cell unit of the respective vehicle,
25 and controlling operations of the fuel cell unit of the respective vehicle.

51. A network communication system of claim 50, wherein said network is the Internet.

30 52. A network communication system of claim 51, wherein the system is adapted to dynamically allocate an Internet IP address to each of said plurality of

vehicles, for facilitating communications with said plurality of vehicles over said network.

53. A network communication system of claim 50, wherein the unique
5 digital identifier is in the form of a PKI certificate, to facilitate encrypted communications over said network.

54. A brokerage system for trading electricity, wherein said electricity is generated by one or more fuel cell units, the system comprising:

10 at least one vehicle being a vendor of electricity, wherein said one or more fuel cell units are operable in said vehicle to generate electricity, said vehicle adapted to negotiate a contract for electricity, said electricity being supplied by said vehicle when coupled to a docking station; and

15 an energy service provider being a purchaser of electricity, wherein said energy service provider obtains said electricity from said vehicle via said docking station and purchases said obtained electricity in accordance with said contract.

20 55. A brokerage system of claim 54, wherein said contract defines one of a fixed or a floating price for electricity obtained from said vehicle.

56. A brokerage system of claim 54, further comprising at least one
25 brokerage client to which said obtained electricity is transmitted.

57. A brokerage system of claim 54, wherein a fuel provider provides fuel to said vehicle for operating said fuel cell units operable therein, said vehicle being further adapted to negotiate a contract for fuel supplied by said energy service provider to said
30 vehicle when said vehicle is coupled to said docking station.

58. A brokerage system of claim 54, wherein a water service provider further obtains water from said vehicle, said water produced by said one or more fuel cell units,

said vehicle being further adapted to negotiate a contract for water obtained from said vehicle and wherein said water service provider purchases said water in accordance with said contract for water.

- 5 59. A method for trading electricity, the method comprising:
negotiating a contract for electricity, wherein said electricity is generated by one or more fuel cell units, wherein said one or more fuel cell units are operable in at least one vehicle to generate electricity, and wherein said electricity is supplied by said vehicle when coupled to a docking station;
- 10 obtaining said electricity from said vehicle via said docking station; and
purchasing said obtained electricity in accordance with said contract.
60. A method of claim 59, wherein said contract defines one of a fixed or a floating price for electricity obtained from said vehicle.
- 15 61. A method of claim 59, further comprising transmitting said obtained electricity to at least one brokerage client.
62. A method of claim 59, further comprising negotiating a contract for fuel,
20 wherein said fuel is supplied to said vehicle when said vehicle is coupled to said docking station, and providing fuel to said vehicle for operating said one or more fuel cell units operable therein.
63. A method of claim 59, further comprising negotiating a contract for
25 water, wherein said water is produced by said one or more fuel cell units, obtaining water from said vehicle, and purchasing said water in accordance with said contract for water.